



## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/JP2004/016838

## Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following \_\_\_\_\_, which is the language of a translation furnished for the purposes of:
- ☐ international search (Rule 12.3 and 23.1(b))
- ☐ publication of the international application (Rule 12.4)
- ☐ international preliminary examination (Rule 55.2 and/or 55.3)
2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:
- ☐ the international application as originally filed/furnished
- ☒ the description:
- pages 1-29, 31 as originally filed/furnished
- pages\* 30 received by this Authority on 24.05.2005
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☒ the claims:
- nos. 1-17 as originally filed/furnished
- nos.\* \_\_\_\_\_ as amended (together with any statement) under Article 19
- nos.\* 21 received by this Authority on 24.05.2005
- nos.\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☒ the drawings:
- sheets 1-18 as originally filed/furnished
- sheets\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- sheets\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.
3. ☒ The amendments have resulted in the cancellation of:
- ☐ the description, pages \_\_\_\_\_
- ☒ the claims, nos. 18-20, 22
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (*specify*): \_\_\_\_\_
- ☐ any table(s) related to sequence listing (*specify*): \_\_\_\_\_
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, nos. \_\_\_\_\_
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (*specify*): \_\_\_\_\_
- ☐ any table(s) related to sequence listing (*specify*): \_\_\_\_\_

\* If item 4 applies, some or all of those sheets may be marked "superseded."

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Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement		
1. Statement			
Novelty (N)	Claims	<u>1-17, 21</u>	YES
	Claims	<u></u>	NO
Inventive step (IS)	Claims	<u></u>	YES
	Claims	<u>1-17, 21</u>	NO
Industrial applicability (IA)	Claims	<u>1-17, 21</u>	YES
	Claims	<u></u>	NO
2. Citations and explanations (Rule 70.7)			
<p>Document 1: Itaya Y. et al., "Law Threshold Current GaInAsP/InP DFB Lasers", In: IEEE Journal of Quantum Electronics, Vol. QE-23, No. 6, June 1987, pages 828 to 834</p> <p>The invention set forth in claims 1 to 3 does not involve an inventive step in the light of document 1 cited in the international search report. Document 1 indicates that an antireflective (AR) surface with a reflectance of 1% is made to serve as the light-emitting surface side of a distributed-feedback semiconductor laser (hereinafter referred to as a "DFB laser"), while a reflective surface (HR) surface with a reflectance of 80% is made to serve as the opposite side; and that a good single vertical mode is obtained by setting the coupling coefficient to <math>100\text{cm}^{-1}</math> and the length of the gain area to <math>100\mu\text{m}</math>.</p> <p>Meanwhile, <math>\Delta\alpha/\text{gth}</math> is also influenced by parameters other than the coupling coefficient of the diffraction grating and the length of the gain generating area, and cannot be directly controlled by a person skilled in the art when designing a distributed-feedback semiconductor laser, and as stated by the applicant in the description,</p>			

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Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability;  
citations and explanations supporting such statement

$\Delta\alpha/gth$  is if anything understood to be a indicator of single mode stability. Therefore the stipulation that a combination of  $\kappa$  and L are used to make  $\Delta\alpha/gth$  at least 1 is understood to indicate the performance of a resultant state in which single mode stability (SMSR value) is good. Therefore this stipulation merely involves adding a feature whereby the generally desirable performance of a high SMSR is represented by other parameters, and it would be easy for a person skilled in the art to conceive of said stipulation.

Document 2: US 4740987 A (McCall Jr. et al.), 26 April 1988, column 2, lines 49 to 61, column 4, lines 28 to 37 & JP 63-027089 A & CA 1277756 A

Document 3: US 4796273 A (Yamaguchi, M.), 3 January 1987, column 3, lines 38 to 54 & DE 3681052 A & EP 195425 A2 & JP 61-216383 A

The invention set forth in claims 4 and 5 does not involve an inventive step in the light of documents 1 to 3 cited in the international search report. Documents 2 and 3 are understood to indicate that in order to obtain a good single mode, the  $\lambda/4$  shift part of a diffraction grating provided to a DFB laser is formed at a position of  $75\% \pm 5\%$  from the light-emitting surface having a low reflectance, therefore it would be easy for a person skilled in the art to employ the known feature set forth in documents 2 and 3 in the invention set forth in document 1.

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	<p data-bbox="298 354 1360 485">Document 4: US 2003/0021319 A1 (Aoki, M), 30 January 2003, paragraphs [0026] and [0027]; fig. 2, 3 &amp; JP 2003-046190 A</p> <p data-bbox="298 554 1393 1381">The inventions set forth in claims 6 to 8, 10 and 15 do not involve an inventive step in the light of documents 1 to 4 cited in the international search report. Document 4 is understood to indicate that the rear surface of a short gain area semiconductor laser is formed by etching, and that the photo diode and etching mirror on the aforementioned rear surface side are formed monolithically, therefore it would be easy for a person skilled in the art to apply the feature set forth in document 4 to the invention set forth in document 1, which has a short gain area and wherein the rear surface is formed by etching. In addition, it would be easy for a person skilled in the art to set the series resistance of the laser element to <math>50\Omega \pm 10\Omega</math> in the invention set forth in document 1, in the light of the fact that it is obvious that series resistance would increase as the gain area becomes shorter, as disclosed in document 4.</p> <p data-bbox="298 1451 1365 1629">Document 5: JP 63-080590 A (Nippon Telegraph and Telephone Corporation), 11 April 1988, page 4, upper left column, line 6 to upper right column, line 24 (Family: none)</p> <p data-bbox="298 1698 1373 1877">The invention set forth in claims 7 to 9 does not involve an inventive step in the light of documents 1 to 3 and 5 cited in the international search report. Document 5 is understood to indicate that the rear</p>

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surface of a semiconductor laser is formed by etching, and that on the aforementioned rear side, a photodiode having a sloped light-receiving surface is formed monolithically, therefore it would be easy for a person skilled in the art to apply the aforementioned feature set forth in document 5 to the invention set forth in document 1, which is similarly formed by etching on the rear surface.

Document 6: JP 03-283483 A (Mitsubishi Electric Corporation), 13 December 1991, claims (Family: none)

Document 7: JP 62-112391 A (Nippon Telegraph and Telephone Corporation), 23 May 1987, page 3, upper right column, lines 6 to 18; fig. 3 and 4 (Family: none)

The invention set forth in claim 11 does not involve an inventive step in the light of documents 1 to 7 cited in the international search report. A DFB laser, having one end surface with a low reflectance and the other end with a high reflectance, wherein the reflectance of the other end is set to at least 90%, is a known technique, as set forth in documents 6 and 7, and it would be easy for a person skilled in the art to apply said feature to the invention set forth in document 1.

Document 8: JP 2002-198611 A (Seiko Epson Corporation), 12 July 2002, claims 1, 2 and 4 (Family: none)

The invention set forth in claims 12 and 13 does not

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	<p>involve an inventive step in the light of documents 1 to 8 cited in the international search report. A semiconductor laser, wherein a hole is made in part of the highly reflective film on one end, and monitor light is drawn through this hole to a photodiode, is disclosed in document 8, and it is a known technique in said technical field to monitor laser light using a photodiode, therefore it would be easy for a person skilled in the art to apply the feature set forth in document 8 to the invention set forth in document 1.</p> <p>Document 9: Nakahara K. et al., "115°C, 12.5-Gb/s direct modulation of 1.3-<math>\mu</math>m InGaAlAs-MQW RWG DFP laser with notch-free grating structure for data com applications", OFC2003 PD40-1 - PD40-3</p> <p>The invention set forth in claim 14 does not involve an inventive step in the light of documents 1 to 9 cited in the international search report. A semiconductor laser, wherein a material containing aluminum, nitrogen, or antimony is employed as a material which constitutes a gain-generating area, is merely a known feature, as set forth in documents 4 and 9, and it would be easy for a person skilled in the art to apply the aforementioned known feature to the invention set forth in document 1.</p> <p>Document 10: US 2002/0159705 A1 (Naniwae, K), 31 October 2002, claim 5, fig. 2 &amp; JP 2002-323628 A</p> <p>The invention set forth in claims 16 and 17 does not</p>

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involve an inventive step in the light of documents 1 to 10 cited in the international search report. Document 10 sets forth a multiple wavelength monolithic laser array and optical module integrating a DFP laser and AWG on a single substrate, and it would not be difficult for a person skilled in the art to constitute the invention set forth in document 1 as a monolithic array or optical module, as set forth in document 10.